

ASSESSING DEVELOPMENT IN RELATION TO SEA LEVEL RISE

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Abstract

In June 2012 the Victorian Government released the *Assessing development in relation to sea level rise* guidelines primarily aimed at catchment management authorities, as part of a broader strategy to enable coastal communities to adapt to the impacts of possible sea level rise over time. The guidelines are backed by the release of new sea level rise mapping through the Government's Future Coasts program.

From a land use planning and development perspective there are two fundamental issues in dealing with sea level rise:

- what rules should be placed on new and infill development commensurate with the risk?
- how do existing communities plan for potential sea level rise?

The guidelines were developed in consultation with the catchment management authorities and relevant government departments over a number of years. They considered Victorian Government policies, local needs and issues, and improvements in the availability of data to assess impacted areas.

The new sea level rise mapping builds on high resolution digital elevation modelling and provides coastal managers and the public with a high level assessment of the potential risks from sea level rise and storm surge at a state-wide to regional scale for four different time periods, up to 2100. It is intended to assist in strategic planning and risk management.

Included in the paper is an overview of the Victorian Government's policy on sea level rise, the issues and concerns that had to be considered in developing the guidelines, how the guidelines are applied and how they provide for more conservative decision-making where appropriate. Feedback from catchment management authorities on the practical application of these guidelines and data is discussed.

The guidelines and mapping represent the next step in a gradual evolution of Victorian policy and practice to manage risks associated with sea level rise to balance competing demands for consistency and local flexibility.

Introduction

Two of the most important recent drivers of coastal planning in Victoria have been:

- the establishment of the government's Future Coasts program in 2007 to identify potential impacts of climate change on the coast and enhance Victoria's ability to respond; and
- the release of the *Victoria Coastal Strategy (2008) (VCS)*, which, among other things, provides the high level policy setting for planning for sea level rise.

Since the release of the VCS, coastal communities, local government authorities, floodplain management authorities (FMAs) and other stakeholders have sought guidance from State government regarding how the policy on planning for sea level rise should be applied. They have also sought more information on how the associated risks

should be considered for existing and future developments in different local environments, and for tools to help decision making.

The development and trialling of the *Guidelines for Coastal Catchment Management Authorities: Assessing development in relation to sea level rise (2012)* (the Guidelines), and of the Future Coasts program products, have been important early steps in the coastal climate change adaptation process. The Department of Sustainability and Environment (DSE) involved a number of authorities in this process, including:

- The Department of Planning and Community Development (DPCD), which provides statutory and strategic guidance about planning in Victoria;
- coastal FMAs, which have floodplain management functions and provide flood advice to local government authorities and others;
- Coastal local government authorities.

As referral authorities, the FMAs (catchment management authorities (CMAs) and Melbourne Water), now provide advice on coastal flooding using the DSE Guidelines and Future Coasts products to ensure that clear and consistent principles can be applied through the planning system at the regional and local levels.

The Guidelines and associated products will be progressively refined over the coming decades as new information becomes available and climate change adaptation theory and practice matures. This steady approach of testing and refining policy and practice is intended to provide a pragmatic response to the relatively long timeframe for sea level rise risks, and provide opportunity for more regional and local adaptation planning.

Also, as roughly 95% of Victoria's current coastline is public land (VCC 2008, p.8), this provides a physical and temporal buffer for modifying the planning system to be robust and resilient to the impacts of climate change.

Victorian Government planning system

Victoria's policy framework for addressing sea level rise is heavily dependent on the planning system as the basis for making planning decisions at the state, regional and local levels.

The *Planning and Environment Act (1987)* sets the legal framework for the standardised planning system adopted in Victoria, collectively known as the Victoria Planning Provisions (VPP). Each municipality uses the VPP as a template for their local planning scheme, which regulates the use, development and protection of their land.

Planning schemes set out the planning rules – the state and local policies, zones, overlays and provisions about specific land uses that inform planning decisions:

- Statewide policies apply to all municipalities. They consider the economic, social and environmental drivers relevant to the entire state. Significant policy statements are incorporated into the State Planning Policy Framework (SPPF) at the front of all planning schemes.
- The next level is the Municipal Strategic Statement. This is developed by each council and articulates the strategic vision for its municipality, together with local planning policies, which are informed by inputs from the local community and others. The Municipal Strategic Statement must be consistent with the SPPF, zones and overlays. These set out the rules and requirements for land use and development. Importantly for FMAs they include a flood zone and flood overlays which are the triggers for FMAs to provide flood advice.

A local council acts as the responsible authority for day to day local planning matters. It assesses permit applications to ensure they are consistent with its planning scheme, and when required refers applications for specialist input from expert referral authorities, such as FMAs.

To assist those applying for planning permits or those involved in assessing planning permit applications practice and advisory notes, and other guidance documents are sometimes produced by DPCD. Other agencies can also produce guidance material. The DSE Guidelines is one such document.

Should a permit applicant, objector or other third party disagree with a planning decision, they are able to seek a review of the merits of the decision before the Victorian Civil and Administrative Tribunal (VCAT).

Current sea level rise policy framework in Victoria

The *Intergovernmental Panel on Climate Change Fourth Assessment Report 2007* (IPCC) projects sea-levels will rise by around 0.8 metres by the end of the century, and that larger rises cannot be ruled out. On the basis of the IPCC report and until national benchmarks for coastal vulnerability are established, a policy of planning for sea level rise of not less than 0.8 m by 2100 should be implemented. (VCC 2008, p.13)

This principle has been recognised by the Commonwealth Department of Climate Change and has been adopted as a strategic policy basis by a number of states including Victoria, though the specific levels and timeframes vary across jurisdictions. (DSE/DPCD 2009 , p.9)

Victoria's current sea level rise policy framework is embodied in the following documents.

At the highest level, the VCS defines the strategies to be applied by decision makers to achieve integrated coastal planning and provide clear direction for the future, principally to:

- plan for a sea level rise of not less than 0.8 metre by 2100 and allow for the combined effects of tides, storm surges, coastal processes and local conditions;
- apply the precautionary principle to planning and management decision-making when considering the risks associated with climate change;
- ensure that new development is located and designed so that it can be appropriately protected from climate change's risks and impacts and coastal hazards. (VCC 2008, p.38)

The VCS also allows for flexibility and on-going adaptation by stating that all plans and strategies relating to the coast consider the most recent scientific information on the impacts of climate change and that as scientific data becomes available, the policy be reviewed. (Ibid, p.13)

The above policy is put into operation by Clause 13 (Environmental risks, Coastal inundation and erosion) and Clause 15 (Managing coastal hazards and the coastal impacts of climate change) of the SPPF.

The VCS also defined actions to be undertaken by DSE and DPCD to provide guidance and decision-making mechanisms. (Ibid, p.38)

Initial guidance on applying the policy was provided at the same time as the release of the VCS by the Minister for Planning's Ministerial Direction 13, DPCD's General

Practice Note “Managing coastal hazards and the coastal impacts of climate change” and DSE’s Advisory Note “How to consider a sea level rise along the Victorian Coast”.

The policy, its embodiment in the SPPF, and the initial guidance was based on the best available science, had built in flexibility that allowed for various adaptation options to be applied at the local level (protect, accommodate, retreat), as well as for review of the policy as better information became available, and had a long planning horizon to minimise the exposure of communities to coastal impacts in the future.

However, this guidance was insufficient to enable consistent application. In particular it was unclear what criteria or methodologies should be used by responsible authorities to plan for, prioritise, manage or avoid the potential risks associated with sea level rise. The allowance for flexibility also resulted in various major stakeholders (councils, referral authorities, developers) developing different views and interpretations on how the policy should be implemented. Where the application of the precautionary approach and long planning horizon was particularly strict, some communities faced an effective halt on development, hindering a pragmatic approach to managing sea level rise risk which would have allowed shorter term or lower risk uses of land potentially subject to sea level rise.

This led to considerable disagreement and a number of coastal climate change related planning cases were brought before VCAT for review. However, various VCAT members had differing interpretations, which only added to the confusion. This highlighted the extent and nature of inconsistencies in the policy and planning framework that needed to be addressed. (Macintosh A 2012, p15)

Development of the Guidelines

As early as 2007, the five coastal FMAs (the four coastal CMAs and Melbourne Water) had requested a state-wide policy that provides guidance to consistently address the potential impacts of climate change on floodplain management. In May 2008, a DSE led working group was set up to develop interim guidelines on how FMAs should provide flood advice in a clear and consistent manner to planning applications referred to them that could in future be potentially affected by climate change induced sea level rise. However, it soon became apparent that such guidelines were part of a bigger picture, as:

- better data was required to identify areas subject to future coastal inundation;
- existing flood overlays did not include coastal inundation;
- there was no guidance on the effects of coastal erosion, how this could be quantified and who was qualified or legally empowered to assess development proposals in this field.

The release of the VCS in December 2008 created the opportunity for departments to work together to develop consistent approaches for addressing coastal climate change issues. As planning for sea level rise and coastal flooding issues had not been considered in detail earlier, the Guidelines underwent a number of iterations over several years. The current version was approved by the Victorian government in June 2012.

The main high level considerations that shaped the approved Guidelines were:

- The need for greater flexibility in looking at future flooding issues. A single planning horizon of 2100 (consistent with the VCS) can prevent opportunities to use land for various purposes in the shorter term, creating problems for existing communities, particularly as properties are redeveloped.

- The need for consistency. Different conditions and decisions on whether or not to develop were being applied inconsistently.
- Concern of some stakeholders that applying a flood level that is tied to a particular period in time (e.g. 2040 or 2100) may not be desirable if sea level rise occurs at a different rate to the current predictions.

The Guidelines are a necessary step in a longer process and may be superseded over time through other broader guidance material (addressing coastal erosion as well as coastal flooding) to be developed by DPCD and DSE.

As the Guidelines were developed, it became apparent that it was extremely important to make a distinction between how new developments outside of existing urban areas will be evaluated compared to infill development. A key consideration was the legacy issue that new development could create for future generations, given that roads, water supply services, sewage services and other infrastructure could be flooded in decades to come.

On the other hand, not allowing a vacant property to be developed in an existing town, where the infrastructure was already in place, or requiring an increase in floor level of 0.8 metres for a replacement dwelling, could be seen as an unnecessary constraint on the health and visual amenity of the existing community.

The government approved Guidelines set out relevant criteria and considerations to be taken into account by coastal FMAs in assessing development proposals that may potentially be affected by sea level rise. While they are specifically aimed at providing guidance to CMAs on how to assess coastal planning applications referred to them, they are publically available to provide transparency in decision making.

The Guidelines also do not apply to the area managed by Melbourne Water. While Melbourne Water was a member of the working group, in the end they opted to produce their own similar guidelines, more tailored to meet local circumstances. The main justification for this was to include a larger area to be assessed for potential sea level rise impacts to better inform the development of plans for protection or adaptation, as in the Melbourne metropolitan area, retreat is not likely to be a viable option. The main implication in the short term is that viable infill development proposals in coastal areas in Melbourne will have slightly higher floor levels.

Structure of the Guidelines

As referral authorities, FMAs are now providing advice on coastal flooding using the methodology in the Guidelines to provide a consistent approach, and using data and products developed by the Future Coasts program to inform decision making.

The Guidelines are short and to the point - 18 pages long, including appendices. Their purpose, application and policy basis is briefly defined up front, followed by a more detailed description of the four step process to be used by CMAs to assess proposals. This is supplemented by supporting notes and guidance.

The four steps are:

- Step 1:** Establish if there is a need to request additional information.
- Step 2:** Assess compliance of the proposal with benchmark flood levels.
- Step 3:** Evaluate the proposal against other relevant considerations.
- Step 4:** Advice/response to responsible authority on application.

The benchmark flood level is the most important consideration when assessing development proposals in coastal areas. This allows the depth of flooding at the site to be determined, which provides the main basis for assessing flood risk. If the depth is too great the site is considered to be unviable for some forms of development. If the depth is not too great a development proposal may usually proceed with various conditions (as per Step 3).

There are two benchmark options outlined in Step 2.

(a) If the proposed development is to accommodate emergency and community facilities or is a greenfield development, the minimum benchmark to be applied is the current 1% Annual Exceedence Probability (AEP) flood level, which includes an allocation for a rise in mean sea level of at least 0.8 m, as well as the impacts of storm surge and tides.

(b) For all other development in existing urban areas, and for new and replacement dwellings and other individual buildings outside existing urban areas, the minimum benchmark to be applied is the current 1% AEP flood level. (DSE 2012, p.7)

Step 3 takes into consideration the specific nature of the proposed development, for example if it is to be a habitable dwelling, commercial development or outbuilding; of what size; life expectancy, etc. If a FMA considers the proposal to have an unacceptable flood risk, it may object to the proposal. Otherwise it raises no objections to the proposed development subject to relevant conditions. These may include:

- In relation to infill development, setting minimum floor levels for building and works to protect development from flooding that in effect require floor levels to be set at least 0.5 m above the current 1% level. This is 0.2 m above what would normally be applied for buildings in flood prone areas, to allow for projected sea level rise over the next few decades. This additional allowance is also consistent with IPPC projections.
- Requiring protection measures such as higher floor levels and setbacks for building and works that may be subject to wave action.
- Setting minimum requirements in relation to foundations, sub floors and cladding to protect against the potential adverse effects of rising sea level.
- Requiring a proposal for a temporary development with a limited lifespan to be removed from the site at a particular point in time.
- Preventing further intensification of development through construction of more than 2 dwellings on a lot, or further subdivision.

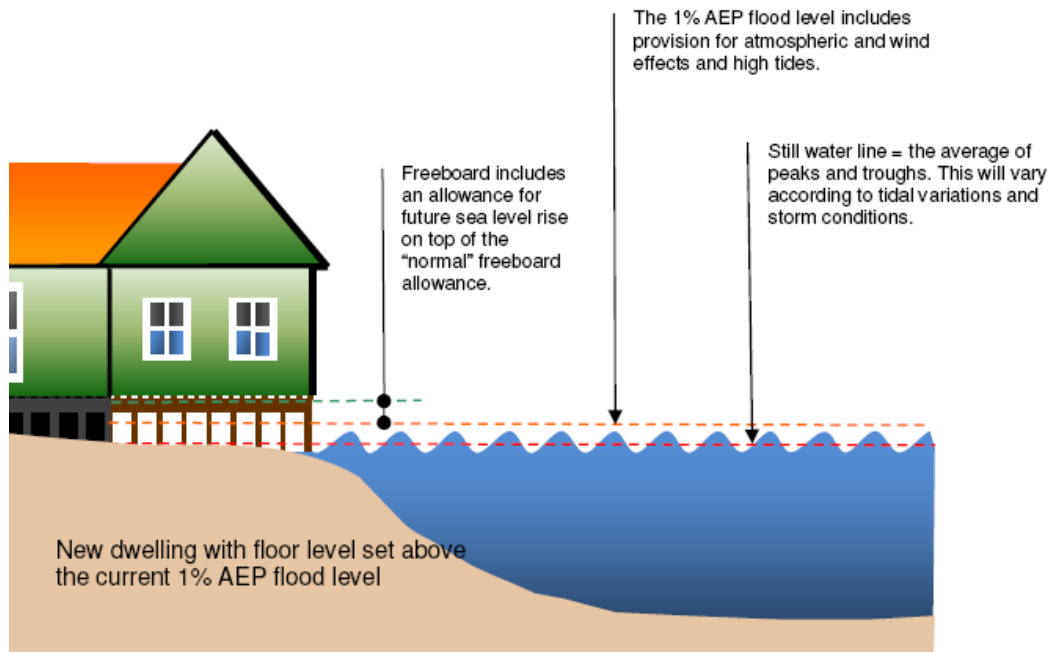


Figure 1: Setting of floor level (DSE 2012, p.9)

Applying the Guidelines

As referral authorities, CMAs are now providing advice on coastal flooding using the methodology in the Guidelines to provide a consistent approach, and using new data and other products developed through the Future Coasts program to inform decision making. Provision has been made in the Guidelines to ensure that where CMAs have already worked with, or are currently working with, councils towards adaptation planning, this work is taken into account.

The positive feedback to date from the CMAs has been that the Guidelines have provided a clear procedure that is consistent across all CMAs. They have allowed a more practical approach towards infill development and redevelopment to be applied, as opposed to more severe measures that a literal interpretation of planning for a sea level rise of at least 0.8 m by 2100 would otherwise require.

However, the CMAs are concerned about the lack of government direction requiring municipal councils to update flood overlays to include coastal flooding.

Flood overlays are the main means for municipal councils to refer development applications to CMAs for flood advice. While there is nothing stopping a council to refer an application to a CMA if it suspects there is a flood problem, this can be problematic without an overlay in place. There are currently no arrangements in place to update flood overlays to include coastal inundation unless part of a riverine flood study.

Currently the CMAs use coastal inundation maps that are derived from the Future Coasts program (described further below). The maps are primarily based on bathtub modelling, using flood levels modelled by CSIRO (McInnes, Macadam and O'Grady 2009). The maps are not intended for planning at the local scale and so the CMAs are presumed to make some allowances for local flood behaviour if they have data to do so. In most cases, however they do not.

Therefore, they stress the need for constant revision and improvement of applicable data and mapping. They also stress the need for better definition of the trigger points in the planning scheme for referrals being sent to them.

The CMAs are also concerned that the maps currently used assume that the coastline in decades to come will be the same as the coastline today, which is not likely to be the case. It is also important to note that the guidelines only deal with individual development applications. They do not address adaptation planning for coastal communities. This aspect will be discussed later.

It is anticipated that the application of the Guidelines will be reviewed as more detailed hazard assessment and adaptation planning is completed to enable a more comprehensive and strategic approach to planning.

Products to assist application of the Guidelines for decision making

As stated in the Introduction, a second major driver of coastal planning in Victoria has been the Future Coasts program. Since 2007, the program has been collating existing and generating new data to produce a variety of products to help practitioners understand the potential coastal hazards associated with climate change and sea level rise, and how the associated risks should be considered for existing and future developments. The main products that have or are being developed include:

- Coastal Digital Elevation Models
- Victorian Coastal Inundation Dataset
- Victorian Coastal Hazard Guide
- Coastal Asset Information Library
- Local Coastal Hazard Assessments
- Historic aerial imagery

For an overview of this information the reader is encourage to visit the following website:

www.climatechange.vic.gov.au/futurecoasts

The *Coastal Digital Elevation Models* (DEM) provide coast-wide high resolution three-dimensional representations of the land from AHD to 10 m elevation (topographic) at 1 m resolution, and sea floor from AHD to 20 m below (bathymetric) at 2.5 and 20 m resolution. CMAs have been using the topographic DEM since its release in 2009 as a key resource to indicate areas that may be more vulnerable to coastal inundation. (DSE 2012a)

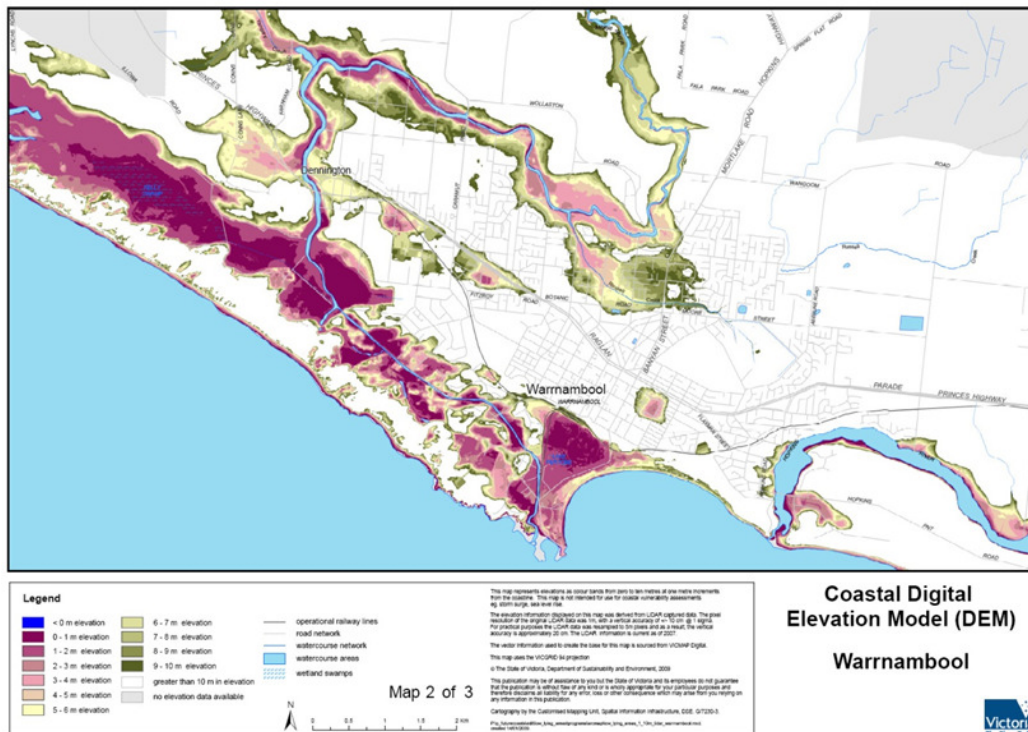


Figure 2: Example of the topographic coastal DEM

The *Victorian Coastal Inundation Dataset* provides indications of the potential impacts of coastal inundation from sea level rise and storm events at a regional to state-wide scale, based on a range of climate change scenarios over time and the elevation of the land. The pdf maps and GIS layers showing modelled sea level rise and storm surge extents for 2009, 2040, 2070 and 2100 were released during the second half of 2012. Instructions on how they can be downloaded can be obtained from www.climatechange.vic.gov.au/futurecoasts.

DSE commissioned a peer review of the methodology used to develop the mapping products. The reviewers found that while a considerable improvement to the Commonwealth Government's first pass assessment there were some limitations, but also some strengths (Water Technology 2012). In relation to assessing development:

- The results were generally slightly conservative.
- The bathtub modelling approach was considered to be reasonable for regional scale applications.
- There were concerns about interpolating the maps to a local scale. The DEM was of a sufficiently high resolution, but the flood levels were coarse and more suited for regional scale appraisals. This could be addressed with more detailed third pass modelling.

CMA's consider the mapping products useful for locating development proposals where a more detailed local assessment is not yet available. However, when assessing development proposals, the CMA's generally use the same flood level information used by the Victorian Coastal Information Dataset. This was derived from CSIRO (McInnes, Macadam and O'Grady 2009).

It is concluded that if CMA's use the datasets for local development assessments the levels are better than anything previously available, but require further refinement.

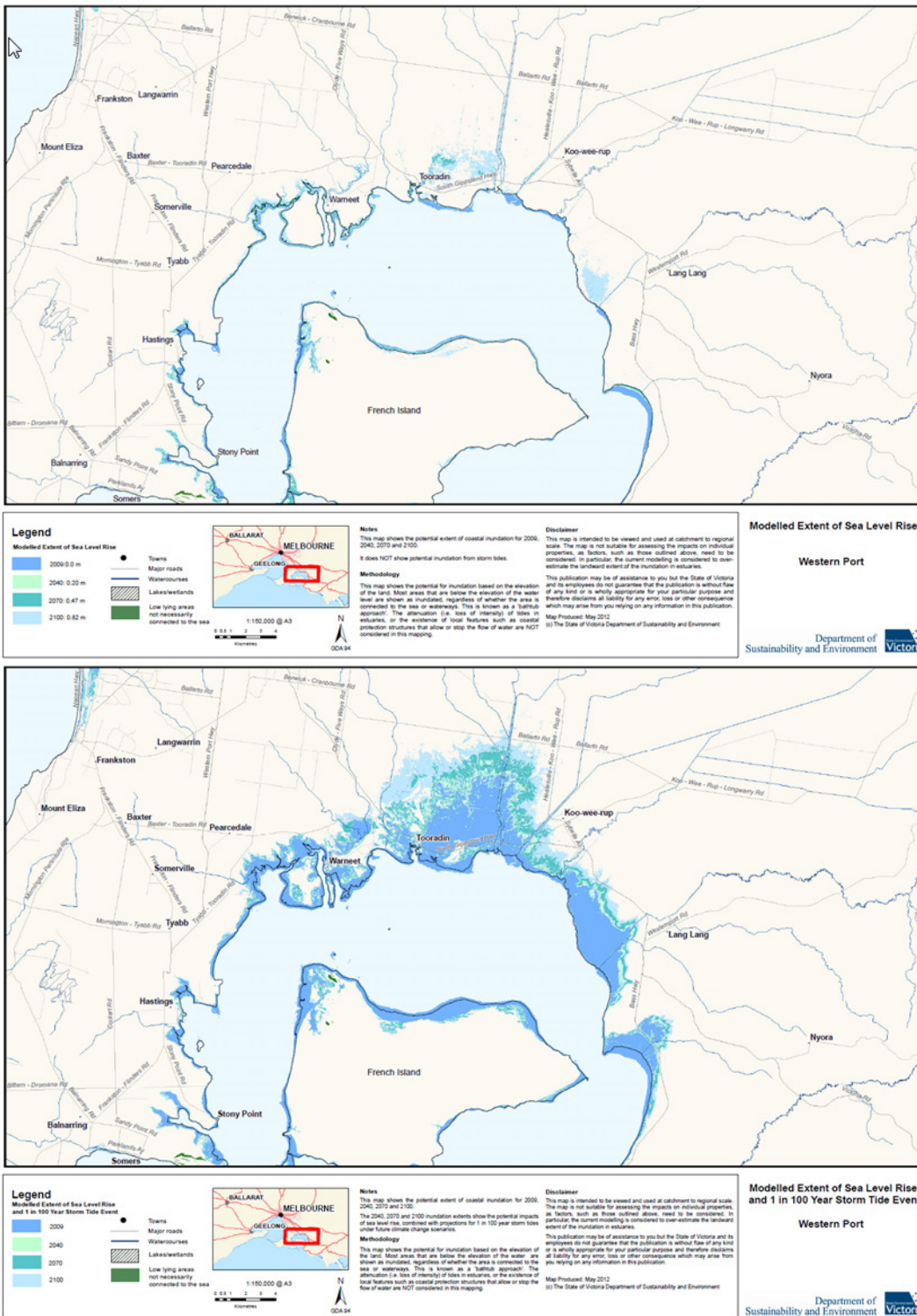


Figure 3: Example of Victorian Coastal Inundation Dataset of Westernport Bay area showing above) modelled sea level rise for 2009, 2040, 2070 and 2100, and below) modelled sea level rise and storm surge extents for 2009, 2040, 2070 and 2100

The *Victorian Coastal Hazard Guide*, which was released in June 20102, describes coastal hazards (such as erosion and inundation), the effect that climate change may have on these hazards, and risk-based approaches that may be used to manage the effects of these hazards. CMAs consider this to be a useful introductory guide and

useful reference document, for example, for councils, in the climate change adaptation planning process. (DSE 2012c)

The *Coastal Asset Information Library* will provide a catalogue of new and existing spatial layers covering Victoria's natural, historical and built coastal assets, as well as data about imagery, hazards, planning and boundary information. It will contain information about each layer's name, unique (ANZLIC) identifier and a link to the layer's metadata statement, which provides a wealth of additional information, such as custodian contact details and any restrictions on accessing the data. CMAs hope the Library, which is scheduled to be released in 2013, will be a useful resource for their assessments. (DSE 2012a)

Local Coastal Hazard Assessments are currently underway and expected to be completed before the end of 2013 at Port Fairy, Bellarine Peninsula-Corio Bay, Western Port and Gippsland Lakes/90 Mile Beach. These four locations are considered to provide a good representation of the Victorian coastline, and as such, the methods used may be applied to future assessments in other coastal locations.

The assessments will prepare detailed data, modelling and information relating to physical coastal hazards (erosion and coastal and catchment inundation), considering locally available information. The information generated will be able to be used for a wide range of regulatory, strategic and statutory management purposes, enabling better decisions to be made about the risks associated with sea level rise and storm surge on the natural and built environment. Coastal CMAs are involved in the technical steering committees of these projects and consider they are filling a significant gap in the data sets needed for better planning for climate change. (DSE 2012a)

Historic aerial imagery captured from the 1950's to now has been collated and will provide empirical evidence for the four local coastal hazard assessments. The imagery provides an indication of how particular shorelines have behaved and changed in the past, which when combined with modelling of the future impacts of rising sea level and increases in coastal storms, will allow assumptions to be tested about future shoreline behaviour in response to sea level rise and storm surges. Aerial imagery has always been used for floodplain management purposes. (DSE 2012a)

Moving forward

To be able to fully manage the impacts of sea level rise on development, state government, local government, floodplain management authorities and developers need:

- accurate mapping to identify the areas potentially impacted;
- information to identify the risk of coastal inundation (storm surge, tidal effects etc.) and/or erosion impacts to determine coastal vulnerability risk;
- continual development and/or improvement of guidance and tools to help understand the risks and options for managing those risks;
- continued wide consultation with stakeholders, including local government, technical experts and community representatives, in order to develop statewide, regional and local strategies for long term adaptation;
- inclusion of the maps and tools in local planning schemes and associated documents.

To complete this work to a reasonable standard for the entire coastline of Victoria will still take many years and require commitment and resources from all stakeholders. In the interim, the Guidelines and Future Coasts products will help consistently deal with development applications from councils, and associated referral authority requests

under planning schemes, based on the best available information, and provide the basis to progressively refine them as newer and better information becomes available.

This is consistent with the historical approach taken for floodplain management issues for at least the last thirty years. However, it must also be remembered that the current policy and guidance are based on predictions, not certainties. Many of the current planning responses to sea level rise may later be judged as over or under reactions to the emerging reality.

While much progress has been made in Victoria in the last four years, it will be a difficult balancing act to allow coastal settlements to remain viable while not allowing the future flood risk to escalate. Long-term climate change adaptation plans need to be produced by regional authorities and local governments to provide the future road maps for local communities.

It is important that adaptation planning is done locally to account for specific social, environmental and economic factors and ensure local stakeholders own the process. By planning ahead, local communities may be able to reduce future impacts by controlling development sensibly (e.g. by upgrading or moving infrastructure over time, by putting funding aside now to save up for a sea wall when it is needed).

Much work still needs to be done to inform adaptation planning, some of which is already underway. The accuracy and validity of existing coastal data needs to continually improve, especially where there are sandy shores and/or high development pressures. The four pilot local coastal hazard assessments (LCHA) in different representative coastal environments in Victoria due to be completed this year are part of this on-going process. These LCHAs will also be used to develop comprehensive guidance for future LCHAs. Once completed, conclusions from LCHAs will be fed into adaptation plans.

Conclusions

The four years since the release of the VCS has been a period of heated debate and trial and error “first pass” fine tuning of sea level rise policy guidance and best practice development to address some of the gaps.

The policy framework is now supported by processes, guidance, data, mapping, and analysis tools provided by the Guidelines and Future Coasts products. The original benchmark of planning for “not less than 0.8 m sea level rise by 2100” fixed in 2008, remains in force, but has been modified in 2012 to also enable more nuanced responses over shorter time frames.

However, while planning for sea level rise in Victoria is much better organised now than it was, there still are concerns over the quantity and quality of available data and information. Continued significant effort from government, communities and individuals will be needed to ensure that risks associated with sea level rise are managed effectively.

References

DPCD 2008, *Managing coastal hazards and the coastal impacts of climate change*, General Practice Note, Victorian Government, Melbourne. DPCD stands for the Department of Planning and Community Development

DSE 2012a, *DSE Future Coasts Products Workshop Participant Handbook*, Victorian Government, Melbourne. DSE stands for the Department of Sustainability and Environment

DSE 2012b, *Guidelines for Coastal Catchment Management Authorities: assessing development in relation to sea level rise*, Victorian Government, Melbourne.
http://www.water.vic.gov.au/_data/assets/pdf_file/0005/145751/Guidelines-for-Coastal-CMAs_FINAL.pdf

DSE 2012c, *Victorian Coastal Hazard Guide*, Victorian Government, Melbourne.

Macintosh A 2012, *Coastal adaptation planning: a case study on Victoria, Australia*. ANU Centre for Climate Law and Policy, Canberra.

Melbourne Water 2012, *Planning for sea level rise: assessing development in areas prone to tidal inundation from sea level rise in the Port Phillip and Westernport Region*, Melbourne Water, Melbourne.

Norman B 2009, *Planning for coastal climate change - An insight into international and national approaches*, Victorian Government, Melbourne. Prepared for the Department of Planning and Community Development.

McInnes, K L, Macadam, I, & O'Grady, J 2009, *The effect of climate change on extreme sea levels along Victoria's coast*, Commonwealth Scientific and Industrial Research Organisation, www.climatechange.vic.gov.au/futurecoasts.

VCC 2008, *Victorian Coastal Strategy 2008*, Victorian Government, Melbourne. VCC stands for Victoria Coastal Council.

Water Technology 2012, *Peer review of the state wide coastal inundation modelling for the Future Coasts Program*, Notting Hill.